Permit to Construct No. P-2008.0049

Public Comment

Hoku Materials, Inc.

Pocatello, Idaho

Facility ID No. 005-00058

July 10, 2008

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Permit Writer

The purpose of this Statement of Basis is to satisfy the requirements of IDAPA 58.01.01.200, Rules for the Control of Air Pollution in Idaho, for issuing air permits.

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Acronyms, Units, and Chemical Nomenclature

acfm	actual cubic feet per minute
AFS	AIRS Facility Subsystem
AIRS	Aerometric Information Retrieval System
AQCR	Air Quality Control Region
ASTM	American Society for Testing and Materials
BACT	Best Available Control Technology
Btu	British thermal unit
CAA	Clean Air Act
CFR	Code of Federal Regulations
CO	carbon monoxide
DEQ	Department of Environmental Quality
gr	grain (1 lb = 7,000 grains)
dscf	dry standard cubic feet
EPA	U.S. Environmental Protection Agency
gpm	gallons per minute
HAPs	Hazardous Air Pollutants
hp	horsepower
IDAPA	a numbering designation for all administrative rules in Idaho promulgated in accordance with the Idaho Administrative Procedures Act
km	kilometer
lb/hr	pound per hour
m	meter(s)
MACT	Maximum Achievable Control Technology
MMBtu	million British thermal units
NESHAP	National Emission Standards for Hazardous Air Pollutants
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NSPS	New Source Performance Standards
PC	permit condition
PM	particulate matter
PM_{10}	particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers
ppm	parts per million
PSD	Prevention of Significant Deterioration
PTC	permit to construct
PTE	potential to emit
Rules	Rules for the Control of Air Pollution in Idaho
scf	standard cubic feet
SIC	Standard Industrial Classification
SIP	State Implementation Plan
SM	Synthetic Minor
SO_2	sulfur dioxide
SO_x	sulfur oxides
T/yr	tons per year
$\mu g/m^3$	micrograms per cubic meter
UTM	Universal Transverse Mercator
VOC	volatile organic compound

1. FACILITY INFORMATION

1.1 Facility Description

Hoku Materials (Hoku) will produce up to 4,000 metric tons per year purified silicon (polysilicon) in a process called chemical vapor deposition. Raw materials used in the production of polysilicon are metallurgical silicon, hydrochloric acid and hydrogen. Emissions from handling metallurgical grade silicon will be controlled by a baghouse and emissions from the polysilicon production process will be controlled by wet scrubbers.

Metallurgical silicon and hydrochloric acid are reacted in a fluidized bed reactor to produce trichlorosilane (TCS), some silicon tetrachloride (STC) is also produced. TCS and STC are separated and stored. TCS is heated and mixed with hydrogen in a batch reactor and polysilicon is produced by a process called chemical vapor deposition. Most of the reactor off gases are recovered in a vent gas recovery system and recirculated back into the process. STC is reacted with hydrogen to produce TCS to be used in the batch reactors.

A more complete facility description can be found in the application materials.

1.2 Permitting History

The following information was derived from a review of the permit files available to DEQ. Permit status is noted as active and in effect (A) or superseded (S).

August 14, 2007	PTC No. P-2007.0075 issued for initial construction of the polysilicon plant. (S)
April 16, 2008	DEQ granted pre-permit construction approval for P-2008.0049, the project for which this statement of basis is being written.

2. APPLICATION SCOPE

Hoku has proposed to increase the polysilicon production from 2,500 metric tons per year to 4,000 metric tons per year. Hoku has also requested to increase the rated input capacity of the emergency generator, fire pump engine, hot oil heater and boiler. The proposed manufacturing process remains the same except that production capacity increases from 2,500 metric tons per year to 4,000 metric tons per year.

2.1 Application Chronology

April 2, 2008	DEQ received a pre-permit construction approval application and a $1,000 permit to construct application fee.
April 11, 2008	Modeling application forms submitted
April 15, 2008	Revised emissions inventory submitted
April 16, 2008	NSPS Subpart IIII applicability information received
April 21, 2008	Modeling supplement received via email

3. TECHNICAL ANALYSIS

Table 3.1 lists all emission units and air pollution control devices included in the application submitted by Hoku.

Table 3.1 EQUIPMENT and AIR POLLUTION CONTROLL DEVICE LISTING

Emissions Units	Emissions Control Device
Silicon Bin – 150 cubic feet	Baghouse
Primary Silicon Feed Bin – 10 ft^3	Baghouse
Secondary Silicon Feed Bin – 15 ft^3	Baghouse
Lime Silo – 500 ft^3 (maximum)	Baghouse
Emergency Generator Set Power: 3,500kW	None
Fire Pump Engine Power: 800 HP	
Hydrochloric Acid Storage and Transfer	Chlorosilane Scrubber (wet scrubber)
Trichlorosilane production	
Trichlorosilane storage	
Silicon tetrachloride storage	
Silicon tetrachloride hydrogenation	
Polysilicon reaction (chemical vapor deposition)	
Impurities removal	
Hot Oil Heater Fuel: Natural Gas Size: 55 MMBtu/hr	None
Boiler Fuel: Natural Gas Size: 55 MMBtu/hr	
Cooling Tower – maximum flow 10,000 gallon/minute	None
Laboratory	Laboratory Scrubber (wet scrubber)
Relief Vent Valves (upset conditions)	Relief Vent Valve Scrubber (wet scrubber)

3.2 Emissions Inventory

Table 5.2 provides and emission inventory summary that was provided by Hoku. All emission estimate calculations are included in the application materials provided by Hoku.

Table3.2 EMISSIONS INVENTORY SUMMARY[1]

Source	**PM/PM_{10}**		**VOC**		**SO_2**		**NO_x**		**CO**		**HCl**	
	lb/hr	**t/yr**	**lb/hr**	**t/yr**	**lb/hr**	**t/yr**	**lb/hr**	**t/yr**	**lb/hr**	**t/yr**	**lb/hr**	**t/yr**
Boiler	0.40	1.74	0.29	1.26	0.031	0.14	5.24	22.94	4.40	19.27		
Hot oil Heater	0.40	1.74	0.29	1.26	0.031	0.14	5.24	22.94	4.40	19.27		
Silicon Bin	0.14	0.60										
Primary Hopper (silicon)	0.03	0.15										
Secondary Hopper (silicon)	0.03	0.11										
Lime Silo	0.21	0.90										
Cooling Tower	1.47	6.43										
Lab Scrubber	0.16	0.70			0.16	0.70	0.96	4.2			0.01	0.03
Chlorosilane Scrubber	1.83	8.01									0.37	1.6
Relief Vent Scrubber	0.73	3.2									0.18	0.80
Generator	3.28	0.82	3.31	0.82	18.97	4.74	112.56	28.14	25.80	6.45		
Fire Pump Engine	0.56	0.14	0.56	0.14	3.24	0.81	19.20	4.80	4.40	1.10		
Fugitive Emissions			0.46	2.00							0.78	3.40
Total	**9.23**	**24.56**	**4.90**	**5.49**	**22.43**	**6.53**	**143.20**	**83.03**	**39.00**	**46.09**	**1.33**	**5.83**

The following paragraphs describe Hoku's emission estimation methodology for all emissions units listed in Table 5.2.

Boiler/Hot Oil Heater

The boiler and hot oil heater will operate on natural gas exclusively. Hoku estimated emission using US EPA AP-42 (Section 1.4) emissions factors and assumed the boilers operated at maximum capacity during every hour of the year. These emission estimates are accepted as representing emissions from the boiler and heater.

Silicon Bin/Primary Silicon Hopper/Secondary Silicon Hopper/Lime Silo

Emissions from storing and handling metallurgical silicon and the lime silo are controlled by baghouses. There are four baghouses, one dedicated to the Silicon Bin, one to the Primary Hopper, one to the Secondary Hopper, and one to the lime silo. Hoku estimated emission by assuming the baghouses would control emissions of PM and PM_{10} to 0.02 grains per dry standard cubic foot. This "grain loading" was multiplied by the flow rate of gas leaving each baghouse to obtain the emission rate in pounds per hour. Baghouses are capable of achieving the stated "grain loading" if they are properly designed, therefore the emission estimation methodology was accepted. The permit has been written to require that the permittee maintain documentation from the baghouse manufacturer guaranteeing each of the baghouses to have PM_{10} emissions less than or equal to 0.02 grains per dry standard cubic foot.

[1] Emission inventory from Hoku dated April 15, 2008

Cooling Tower

Cooling tower emissions were estimated using US EPA AP-42 (Section 13.4) emission factors. This emission estimation method is accepted as representing emissions from the cooling tower. Emissions are dependent on the circulating water flow rate and the concentration of solids in the water.

Emergency Generator/Fire Water Pump Engines

The emergency generator and fire water pump are both powered by a diesel engine. Emissions were estimated using US EPA AP-42 (Section 3.3) emission factors. The engines were assumed to operate at maximum capacity for up to 500 hours per year. This emission estimation method is accepted as representing emissions from the engines which will actually only operate for maintenance and readiness preparedness (other than emergency situations).

Chlorosilane Scrubber

Emissions from the following emission units vent to the chlorosilane scrubber (as seen in the process flow diagram provided by Hoku).

- HCl storage and transfer
- Trichlorosilane Production (TCS)
- Trichlorosilane Purification
- Trichlorosilane Storage
- Polysilicon Reaction
- Silicon Tetrachloride storage and Hydrogenation
- Vent Gas Recovery

Hoku stated that emissions from the chlorosilane scrubber would be similar to the permitted emission rate of a chlorosilane scrubber located at a polysilicon plant in Alabama. However, Hoku was not able to confirm that the Alabama plant had the same design and the same emission units as the proposed Hoku operations. In addition, the types of scrubbers that will be used at the Hoku facility and the type of scrubber used at the Alabama plant are unknown.

In absence of justified emission factors from a identical or very similar plant, or engineering calculations that estimate emissions from the plant, a HCl continuous emission monitor (CEM) is required by the permit to assure compliance with the requested emission rate limits.

In the future Hoku may request to remove the HCl CEM by providing an uncontrolled emission inventory for each of the emission units that vent to the chlorosilane scrubber along with detailed description of the operation of the emission units and documentation of the scrubbers control efficiency. If Hoku proposes to use emission factors from a similar plant an argument of why the emission factors are appropriate for use must be provided. At a minimum this would include:

- Proof that the plants are similar in design (i.e. under what circumstances do emission units vent to the scrubber, what are the uncontrolled emissions). This must include a detailed description of the operation of each emission unit that vents to the scrubber.
- Proof that the pollution control devices are similar in control efficiency.

Laboratory Scrubber

Acid use in the laboratory is planned to be less than 5 gallons per day of hydrofluoric acid (HF) and 5 gallons per day of nitric acid (HNO_3). An uncontrolled emission inventory was not provided in the application. If it is assumed that all of the acid used is vented to the scrubber a minimum scrubbing efficiency can be determined that would result in emissions below which air pollutant dispersion modeling is required (i.e. emission would be below the screening emissions level). Given below are calculations that determine the scrubbing efficiencies required to reduce emissions to below the screening emission rates.

HF

HF specific gravity = 0.97
HF emissions = (8.33 lb/gal)(.97)(5 gal/day)(day/24 hr)(1-.9) = 0.17 lb/hr
HF screening emission level = 0.17 lb/hr

The above calculations show that if the scrubber is 90% efficient emissions of HF will be below the screening emission level so that modeling to determine ambient impact is not needed to assure preconstruction compliance.

HNO_3

HNO_3 specific gravity = 1.5
HNO_3 = (8.33 lb/gal)(1.5)(5 gal/day)(day/24 hr)(1-.9) = 0.26 lb/hr
HNO_3 screening emission level = 0.33

The above calculations show that if the scrubber is 90% efficient, emissions of HNO_3 will be below the screening emission level so that modeling to determine ambient impact is not needed to assure preconstruction compliance.

3.3 Ambient Air Quality Impact Analysis

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The facility has demonstrated compliance to DEQ's satisfaction that emissions from this facility will not cause or significantly contribute to a violation of any ambient air quality standard. The facility has also demonstrated compliance to DEQ's satisfaction that emissions increase due to this permitting action will not exceed any AAC or AACC for TAPs. The modeling analysis report submitted by Hoku may be seen in Appendix B of this statement of basis. The submitted modeling analyses: 1) utilized appropriate methods and models; 2) was conducted using reasonably accurate or conservative modeling parameters and data; 3) adhered to established DEQ guidelines for new source review dispersion modeling; 4) showed that predicted pollutant concentrations from emissions associated with the facility, when appropriately combined with background concentrations, were below applicable air quality standards at all receptor locations.

Table 3.3 FULL IMPACT ANALYSIS RESULTS FOR CRITERIA POLLUTANT(S)

Pollutant	Averaging Period	Facility Ambient Impact (µg/m3)	Background Concentration (µg/m^3)	Total Ambient Concentration (µg/m^3)	NAAQS (µg/m^3)	Percent of NAAQS
PM_{10}	24-hour	45.3	94.6	139.9	150	93.3 %
	Annual	9.6	25	34.6	50	69.2 %
NO_2	Annual	8.2	32	40.2	100	40.2 %
SO_2 (a)	3-hr	239	34	273	1,300	21 %
	24-hr	50.7	26	76.6	365	21 %
	Annual	8.8	8	16.8	80	21 %
CO	1-hour	464	5,000	5,464	40,000	13.7 %
	8-hour	136	2,000	2,136	10,000	21.4 %
Pb	Quarterly	NA	NA	NA	1.5	NA

NA: The emissions rate is below the modeling threshold; modeling is not required in accordance with State of Idaho Air Quality Modeling Guidance DEQ Publication, December 2002, or alternative threshold approved by DEQ Modeling Coordinator.
(a) Ambient impact presented in Hoku's April 21, 2008 submittal.

Table 3.4 FULL IMPACT ANALYSIS RESULTS FOR TAP(S)

Pollutant	Average Period	Concentration (µg/m^3)	Regulatory AAC/AACC (µg/m^3)	Percent of AAC/AACC
Arsenic	Annual	0.00001	2.3E-04	4.3%
Benzene	Annual	0.00024	1.20E-01	0.2%
Benzo(a)pyrene	Annual	<0.00001	3.00E-04	<3.3%
Cadmium	24-hour	0.00008	5.6E-04	14.2%
Formaldehyde	Annual	0.00452	7.7E-02	5.9%
HCL	24-hour	267	375	71.2%
Nickel	Annual	0.00015	4.20E-03	3.6%
PAH	Annual	<0.00001	0.014	<0.1%

4. REGULATORY REVIEW

4.1 Attainment Designation (40 CFR 81.313)

The facility is located in Bannock County which is designated as attainment or unclassifiable for $PM_{2.5}$, CO, NO_2, and Ozone; and attainment for PM_{10} and SO_2. Reference 40 CFR 81.313.

4.2 Permit to Construct (IDAPA 58.01.01.201)

Hoku Materials has proposed modifying operations such that proposed changes would not comply with the terms and conditions in the current permit to construct that establishes the facility emissions cap (FEC) for the facility. Therefore a permit to construct modification is required.

Hoku Materials requested pre-permit construction approval in accordance with IDAPA 58.01.01.213

and was granted pre-permit construction approval on April 16, 2008. The facility may commence construction but may not operate the modifications until the final permit is issued.

4.3 Title V Classification (IDAPA 58.01.01.300, 40 CFR Part 70)

The facility is a Title V (Tier I) minor facility and is not required to obtain a Tier I operating permit. The facility is a minor facility because the total of all hazardous air pollutant (HAP) emissions are less than 25 tons per year, there is no single HAP that is emitted in quantities greater than or equal to 10 tons per year, and the facilities potential to emit other regulated air pollutants is less than 100 tons per year.

4.4 PSD Classification (40 CFR 52.21)

The Hoku Materials facility is not a designated facility and the facilities potential to emit is less than 250 tons per year. Therefore Hoku Materials is a PSD “minor” facility.

4.5 NSPS Applicability (40 CFR 60)

40 CFR 60.4200……………………… Standards of Performance for Stationary Compression Ignition Internal Combustion Engines

Hoku is installing two compression ignition internal combustion engines. The engines are affected emission units in accordance with 40 CFR 60.4200(a)(2) because:

- The emergency generator engine is manufactured after April 1, 2006.
- The fire water pump engine is a certified National Fire Protection Association fire pump engine after July 1, 2006.

Emissions from the emergency generator must comply with the emission standards for new nonroad compression ignition engines in 40 CFR 60.4202 and 60.4205. These sections reference 40 CFR 89.112 and 40 DFR 89.113 where the actual emission limits are given. Emissions from fire pump engines must comply with the emission standards in Table 4 to 40 CFR 60.4200. The NSPS assumes that if an affected facility complies with operating requirements specified in the NSPS it will be in compliance with the emission limits.

Owners and operators of stationary compression ignition engines subject to emissions standards of 40 CFR 60.4205 shall achieve the emissions standards according the manufacturer’s written instruction or procedures developed by the owner or operator that are approved by the engine manufacturer, over the entire life of the engine.

These NSPS requirements are included in the permit in Section 4.

40 CFR 60.40c……………………… Standards of Performance for Small Industrial Steam Generating Units

The hot oil heater and boiler are each affected emission units in accordance with 40 CFR 60.40c(a) because they have a design heat input of 55 MMBtu/hr and construction commenced after June 9, 1989. The hot oil heater is an affected steam generating unit, because as defined in 40 CFR 60.40c a steam generating unit is a device that combusts fuel to produces steam or heats water or any other heat transfer medium; oil is a heat transfer medium making the hot oil heater an affected emission unit.

These NSPS requirements are included in the permit in Section 6.

4.6 NESHAP Applicability (40 CFR 61)

Hoku Materials process equipment does not include any emissions units that are defined as affected by any of the Subparts of 40 CFR 61.

4.7 MACT Applicability (40 CFR 63)

40 CFR Subpart BBBBB—National Emission Standards for Hazardous Air Pollutants for Semiconductor Manufacturing.

Hoku is not an affected facility under the National Emission Standards for Hazardous Air Pollutants for Semiconductor Manufacturing because Hoku is not a major source of hazardous air pollutants.

4.8 CAM Applicability (40 CFR 64)

Hoku is not a Tier I major facility nor is it required to obtain a Tier I operating permit, therefore the requirements of CAM are not applicable.

4.9 Permit Conditions Review

This section describes only those permit conditions (PC) that have been added, revised, modified or deleted as a result of this permitting action. All other permit conditions remain unchanged.

Permit conditions 1.1, 2, and 5.4 have been modified to reflect the facilities permitted production capacity from 2,500 metric tons per year to 4,000 metric tons per year.

Permit Condition 2.1:

Permit conditions 2.1 contains the facility wide emission cap (FEC) limitation for the facility. The Existing Permit condition 2.1 has been modified to include a new FEC which limits emissions from producing 4,000 metric tons of polysilicon per year instead of 2,500 metric tons per year.

Existing PC 2.1

2.1 <u>Criteria Pollutant and HAP Facility Emissions Cap</u>

Emissions from the Hoku Materials facility shall not exceed any corresponding facility emission cap (FEC) limits listed in Table 2.2.

Table 4.1 FEC EMISSIONS LIMITS[1]

Source Description	PM/ PM_{10}	SO_2	NO_X	VOC	CO	Individual HAP	Aggregated HAPs
	T/yr	T/yr	T/yr	T/yr	T/yr	T/yr	T/yr
Total Facility Emissions Cap	15.24	4.34	60.35	3.73	33.47	3.22	3.87

1) Emission limits are in tons per consecutive 12-calendar month period.

Revised PC 2.1

2.2 Criteria Pollutant and HAP Facility Emissions Cap

Emissions from the Hoku Materials facility shall not exceed any corresponding facility emission cap (FEC) limits listed in Table 2.2.

Table 4.2 FEC EMISSIONS LIMITS[1]

Source Description	PM/PM_{10}	SO_2	NO_X	VOC	CO	Individual HAP	Aggregated HAPs
	T/yr	T/yr	T/yr	T/yr	T/yr	T/yr	T/yr
Total Facility Emissions Cap	24.56	6.53	83.03	5.49	46.09	5.83	6.72

1) Emission limits are in tons per consecutive 12-calendar month period.

Permit Table 4.1

Table 4.1 has been updated to allow an increase of the emergency generators capacity from 2,500 kW to 3,500 kW, and to increase the fire pump engines capacity from 575 horsepower to 800 horsepower.

Permit Table 6.1

Table 6.1 has been updated to allow an increase of the input capacity of the Hot Oil Heater and the Boiler from 40 MMBtu to 55 MMBtu.

All other permit conditions remain unchanged.

5. PERMIT FEES

Table 5.1 lists the processing fee associated with this permitting action. The facility is subject to a processing fee of $5,000 because the permitted emissions increase is 48.6 tons per year. Refer to the chronology for fee receipt dates.

Table 5.1 PTC PROCESSING FEE TABLE

Emissions Inventory			
Pollutant	**Annual Emissions Increase (T/yr)**	**Annual Emissions Reduction (T/yr)**	**Annual Emissions Change (T/yr)**
NO_X	22.63	0.0	22.63
SO_2	2.23	0.0	2.23
CO	12.59	0.0	12.59
PM_{10}	9.36	0.0	9.36
VOC	1.79	0.0	1.79
HAPS	0.0	0.0	0.0
Total:	0.0	0.0	**48.6**
Fee Due	**$ 5,000.00**		

6. PUBLIC COMMENT

An opportunity for the public to request a comment period on DEQ's proposed action was provided between April 16, 2008 and April 30, 2008. On April 30, 2008 DEQ received a request for a public comment period, therefore a 30 day public comment period will be provided on DEQ's proposed action in accordance with IDAPA 58.01.01.209.01.c.

APPENDIX A – AIRS INFORMATION

AIRS/AFS[a] FACILITY-WIDE CLASSIFICATION[b] DATA ENTRY FORM

Facility Name: Hoku Materials
Facility Location: Pocatello
AIRS Number: 005-00058

AIR PROGRAM POLLUTANT	SIP	PSD	NSPS (Part 60)	NESHAP (Part 61)	MACT (Part 63)	SM80	TITLE V	AREA CLASSIFICATION A-Attainment U-Unclassified N- Nonattainment
SO_2	B		B					A
NO_x	B		B					U
CO	B		B					U
PM_{10}	B							A
PT (Particulate)	B		B					
VOC	B							U
THAP (Total HAPs)	SM						SM	
			APPLICABLE SUBPART					
			Dc, IIII					

[a]Aerometric Information Retrieval System (AIRS) Facility Subsystem (AFS)

[b]AIRS/AFS Classification Codes:

A=Actual or potential emissions of a pollutant are above the applicable major source threshold. For HAPs only, class "A" is applied to each pollutant which is at or above the 10 T/yr threshold, **or** each pollutant that is below the 10 T/yr threshold, but contributes to a plant total in excess of 25 T/yr of all HAPs.

SM=Potential emissions fall below applicable major source thresholds if and only if the source complies with federally enforceable regulations or limitations.

B=Actual and potential emissions below all applicable major source thresholds.

C=Class is unknown.

ND=Major source thresholds are not defined (e.g., radionuclides).

APPENDIX B – HOKU MODELING REPORT

APPENDIX D

MODELING REPORT

AIR QUALITY MODELING REPORT
HOKU SCIENTIFIC, POCATELLO

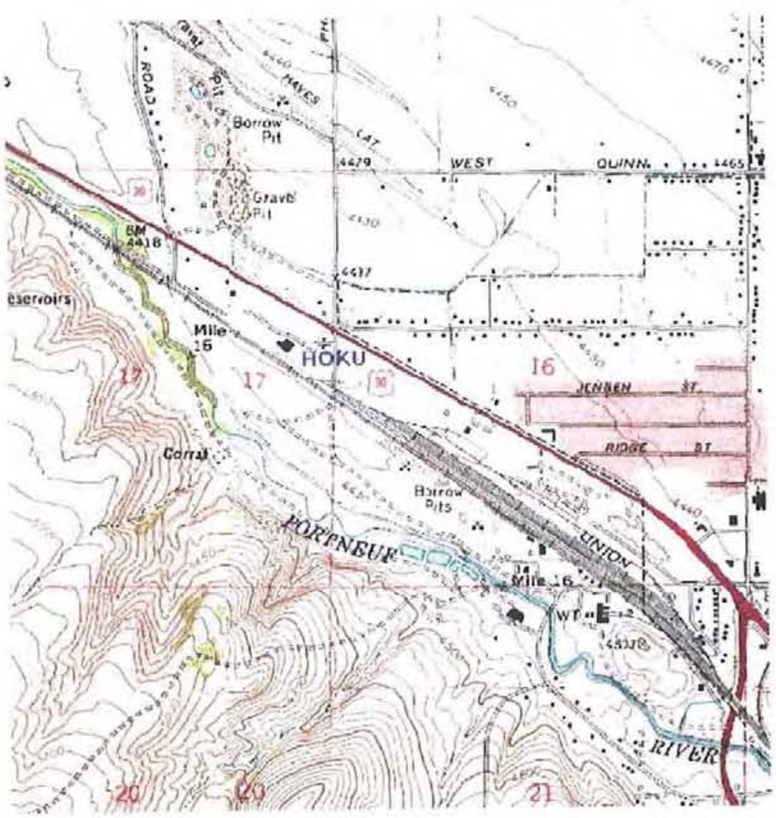
PURPOSE

This air quality modeling report describes modeling prepared to support proposed modifications to the permit issued in 2007. The templates for this protocol are the modeling report IDEQ approved for the 2007 modeling analyses, and the March 2008 modeling protocol approved by IDEQ (a copy of which is included in Appendix C). The only deviation from the approved modeling protocol is an adjustment of the location of buildings and sources on the facility to make sure they are consistent with current design and construction plans. Kevin Schilling provided written acknowledgement, copied in Appendix C, that the approved protocol would remain valid with those changes. This document describes the air quality analyses prepared to support the Permit to Construct (PTC) modification for the planned Hoku Scientific polysilicon plant off Highway 30 in northwest Pocatello.

INTRODUCTION

This modeling analysis was prepared to support the facility's application for a permit modification, which includes a Facility Emission Cap (FEC) consistent with IDAPA 58.01.01 air quality regulations. The facility will remain a Title V minor source. The modeling was prepared consistent within IDEQ approved modeling protocol. Figure 1 below shows the facility location.

Figure 1 Hoku Scientific Facility Location



MODEL DESCRIPTION / JUSTIFICATION

The model chosen is AERMOD, the US EPA approved model recommended by IDEQ. AERMOD has recently replaced the Industrial Source Complex model ISCST3 as the primary recommended model for facilities with multiple emission sources. AERMOD was applied as recommended in EPA's *Guideline on Air Quality Models*, consistent with guidance in IDEQ's *Air Quality Modeling Guideline*. Recommended regulatory default options were employed. Terrain data was processed consistent with the IDEQ guidance, discussions with IDEQ's Mr. Schilling, and EPA guidance for AERMAP, as documented in the IDEQ-approved modeling protocol. Meteorological data recommended for this application was supplied by IDEQ. The Prime building downwash algorithm was employed. Modeling analyses were performed for all pollutants emitted above IDEQ emission thresholds. That included PM-10, and NO_2, CO and SO_2, and toxic air pollutants (TAPs) exceeding the IDAPA 58.01.01.585 or 586 emission levels (ELs). The TAP impact analyses conservatively include all facility emissions for each TAP, though IDEQ requires impact analyses from only increases in TAP emissions from those currently permitted. Chemical transformation of emissions was not considered. All these details were included in the modeling protocol which IDEQ approved. The only condition of IDEQ's acceptance is addressed in this analysis.

EMISSION AND SOURCE DATA

Model stack and emissions data representative of the worst case emissions at the Hoku Scientific facility were incorporated directly into the air quality modeling analysis. This generally represented slightly higher capacity equipment and process design than originally permitted, with stronger exhaust flows and increased emission rates. All model stack parameters except the emission rates were provided by the engineers designing the facility and construction plans. The project engineers report that in all cases, the stack gas temperatures and flow rates were determined using "standard of care" engineering analysis. These parameters were determined from the process needs (combustion, ventilation, pressure) with guidance from equipment suppliers and or licensors. Emission rates modeled for each pollutant are the maximum emissions under proposed operations over the duration of the standard for that pollutant. That results in different emission rates for the same pollutant for annual and shorter term averaging period analyses. The derivation of all emission rates is documented in the permit application this modeling report accompanies.

The emission inventory was developed consistent with worst-case conditions anticipated during operation at the facility consistent with current facility plans. The facility emissions were conservatively estimated to exceed IDEQ modeling thresholds for criteria pollutants PM-10, NOx, SO_2, and CO, IDAPA 58.01.01.585 TAP HCL, and six IDAPA 58.01.01.586 TAPs. The modifications proposed from currently permitted activities are limited to changes in emission rates, stack diameters, and stack exit velocities, and a realignment of processes and development across the Hoku facility property. No new sources are included as compared to the original permit, but changes in location are proposed for previously permitted emission point or area source.

Table 1 summarizes the pollutant emission data consistent with the proposed modification. The changes from draft model source data presented in the IDEQ-approved modeling protocol are limited to differences identified in Q/A against the final permit emission inventory.

Modeling analyses were performed for all pollutants listed in Table 1 to estimate maximum impacts during each averaging period for which an applicable ambient air quality impact limit exists. All model sources had emissions understood to represent worst-case permitted emissions for each averaging period to estimate the worst case impacts under allowable emissions from the facility. The Hoku stack parameters represent planned actual emissions scenarios. Potential worst-case impacts for each pollutant and averaging period were directly output by the model. All model source data underwent quality assurance review by JBR Environmental, the engineers designing the facility, and the facility owners and representatives.

The facility submits this application in accordance with facility-wide emissions cap (FEC) sections of IDAPA 58.01.01.175 – 181. Consistent with FEC requirements, this analysis may be updated as necessary during the term of the FEC permit to ensure that the analysis estimates worst-case impacts during actual and potential operations within the permit.

Building downwash was accounted for by including in the AERMOD model analysis Prime building downwash from all buildings within the facility. All Hoku buildings and tanks over 10' tall are included in the building downwash analysis included in the modeling. Appendix A provides a summary of the building downwash run analysis and results from the BPIP-Prime input and output files.

One external potential co-contributing source recommended by IDEQ, Great Western Malting, was included in the modeling analysis using data provided by IDEQ. The buildings at Great Western Malt were also included in the BPIP building downwash calculations for this analysis. Great Western model sources are those in Table 1 that do not include a source description. The impact of the Hoku facility in combination with the IDEQ-recommended co-contributing source is provided with the analysis results reported later in this document.

Figure 2 shows the model layout, with the facility property / ambient air boundary. Facility buildings and tanks are shown in black within the facility boundary, and facility emission sources are shown and labeled in red. The blocks and overwritten red labels to the bottom right of the Hoku property boundary represent the buildings and emission points for the Great Western Malt sources included in the modeling analysis. The background grid is the UTM coordinate system, NAD 27, whose units are in meters. The dots beyond the property boundary indicate the inner-most model receptors. Finer details of this figure are included in the electric data file submission and in Appendix B, with the views broken up for the E and W side to allow a zoomed view of detail.

Table 1 Model Source Data

POINT SOURCES			Easting (X)	Northing (Y)	Base Elev	Stack Height	Temp	Exit Velocity	Stack Diam	PMTEN	PMTENAN	NOX	SO2	SO2AN	CO	HCL	NG TAPS	BENZENE
Source ID	Stk Rel Typ	Source Description	m	m	m	ft	°F	fps	ft	lb/hr	tpy	tpy	lb/hr	tpy	lb/hr	lb/hr	tpy	tpy
BH1	DEF		378487.0	4750062.0	1353.0	24.0	60.0	0.003	0.00	0.0663	0.290							
BH2	DEF		378516.2	4750070.0	1353.0	113.0	60.0	0.003	0.00	0.1357	0.594							
BH3	DEF		378485.4	4750090.5	1353.0	113.0	60.0	0.003	0.00	0.0841	0.368							
KSE01	DEF		378483.0	4750053.0	1353.0	104.0	65.0	6.201	20.64	0.1698	0.744							
KSE02	DEF		378493.4	4750046.0	1353.0	104.0	65.0	6.201	20.64	0.1698	0.744							
KSE03	DEF		378504.2	4750039.0	1353.0	104.0	65.0	6.201	20.64	0.1698	0.744							
KSE04	DEF		378516.1	4750031.0	1353.0	104.0	65.0	6.201	20.64	0.1698	0.744							
KSE05	DEF		378526.4	4750023.5	1353.0	104.0	65.0	6.201	20.64	0.1698	0.744							
CS	DEF		378478.8	4750064.0	1353.0	96.5	100.0	0.003	2.33	0.3302	1.446							
BS1	DEF		378535.0	4750011.0	1353.0	112.0	350.0	17.454	2.92	0.3802	1.665							
BS2	DEF		378472.5	4750067.0	1353.0	34.0	400.0	0.003	0.00	0.0190	0.083							
BOILER	DEF	Plant Boiler	377688.0	4750349.0	1353.6	20.0	400.0	47.157	3.00	0.4000	1.740	22.942	0.031	0.140	4.400		0.5	3.50E-04
HOH	DEF	Hot Oil Heater	377679.0	4750356.0	1353.3	20.0	400.0	47.157	3.00	0.4000	1.740	22.942	0.031	0.140	4.400		0.5	4.80E-04
EMG	DEF	Emergency Generator	377521.0	4750503.0	1352.4	26.0	800.0	111.408	2.00	3.2800	0.820	28.140	8.970	4.740	25.800			0.00232
FP	DEF	Fire Pump	378118.0	4750038.0	1353.0	20.0	800.0	95.493	1.00	1.7600	0.440	6.200	1.640	0.410	5.340			3.95E-04
COOL1	DEF	Cooling Tower cell	377558.5	4750476.0	1354.1	30.0	84.0	17.323	35.00	0.4900	2.144							
COOL2	DEF	Cooling Tower cell	377566.0	4750487.5	1354.5	30.0	84.0	17.323	35.00	0.4900	2.144							
COOL3	DEF	Cooling Tower cell	377574.0	4750500.0	1354.3	30.0	84.0	17.323	35.00	0.4900	2.144							
SBV	DEF	M.G. Silicon Bin Vent	377463.0	4750554.0	1350.7	24.0	68.0	67.906	0.50	0.1400	0.600							
SPFH	DEF	M.G. Silicon Primary Feed Hopper	377460.0	4750520.8	1349.7	65.0	68.0	147.029	0.17	0.0300	0.150							
SSFH	DEF	M.G. Silicon Secondary Feed Hopper	377470.0	4750519.0	1350.0	60.0	68.0	110.272	0.17	0.0300	0.110							
LIME	DEF	Lime Storage System	378143.0	4750055.0	1353.0	20.0	68.0	25.465	1.00	0.2100	0.900							
LABSCRB	DEF	Lab Scrubber	377923.0	4750113.0	1352.6	20.0	68.0	55.174	1.00	0.1600	0.700	4.200	0.160	0.700		0.007		
CSS	DEF	Chlorosilane Scrubber System	377618.0	4750300.0	1352.0	27.0	68.0	49.615	1.17	1.8300	8.010					0.37		
RVS	DEF	Relief Vent Scrubber	377646.0	4750273.0	1352.1	27.0	68.0	49.615	1.17	0.7300	3.200					0.18		

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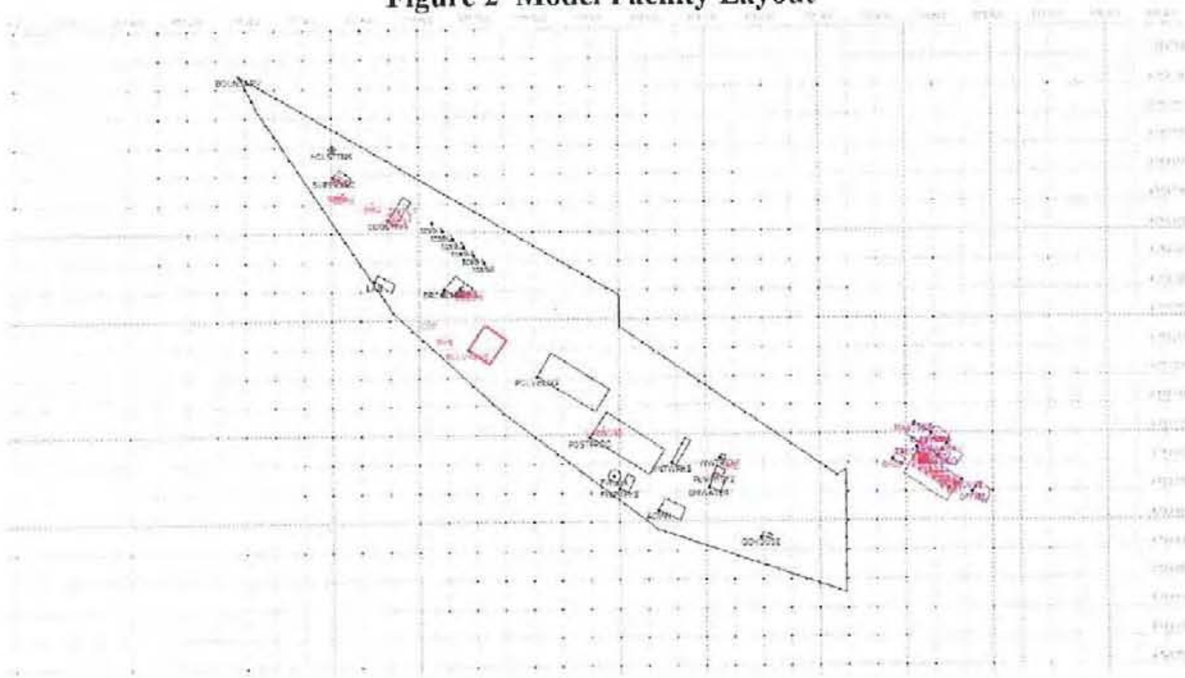
AREA SOURCES		Easting (X)	Northing (Y)	Base Elevation	Release Height	Easterly Length	Northerly Length	Angle from North	Vertical Dimension
Source ID	Source Description	(m)	(m)	(m)	(ft)	(ft)	(ft)		(ft)
HCLVALVE	fugitive HCl from valves	377686.0	4750248.0	1350.3	5.0	150.0	170.0	35	8.0

VOLUME SOURCES		Easting (X)	Northing (Y)	Base Elevation	Release Height	Horizontal Dimension	Vertical Dimension	PMTEN
Source ID	Source Description	(m)	(m)	(m)	(ft)	(ft)	(ft)	(lb/hr)
TB		378484	4750070	1353	56.50	38.68	52.56	0.417
RB		378510	4750098	1353	56.50	38.68	52.56	0.267

Figure 2 Model Facility Layout



RECEPTOR NETWORK / MODEL DOMAIN

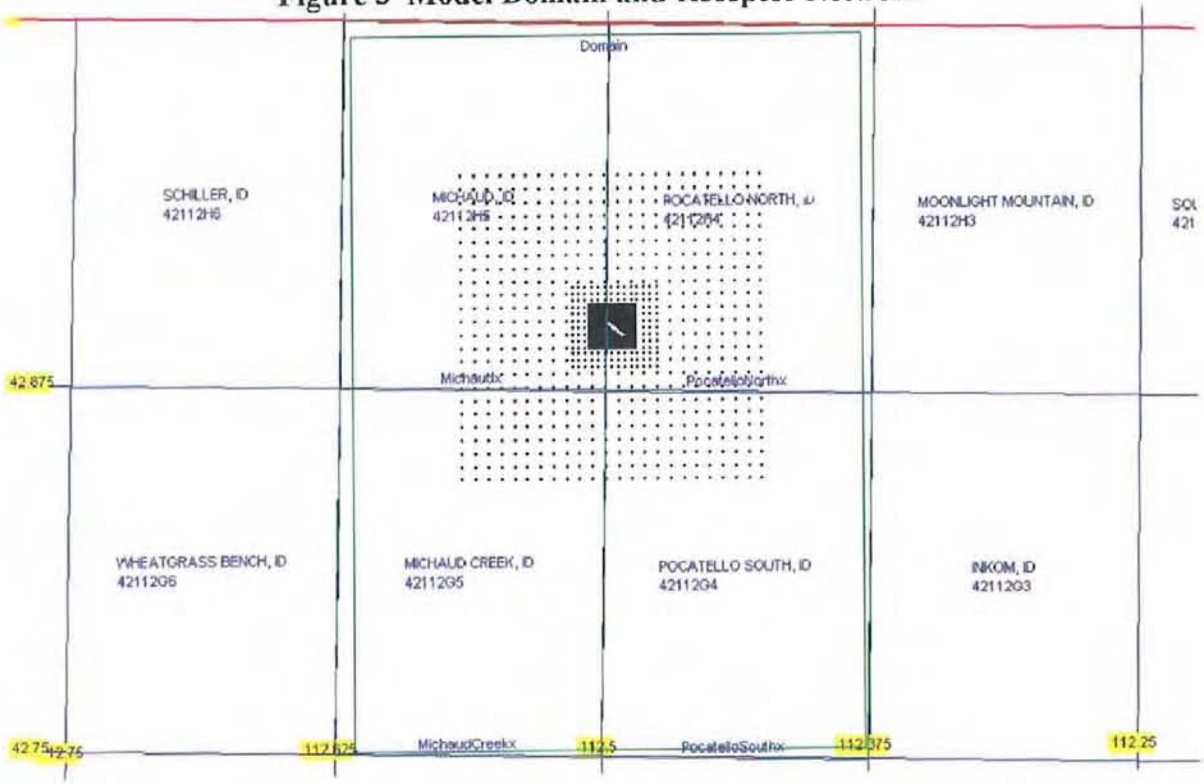
All details described in this section are exactly as described in the IDEQ-approved modeling protocol, and the IDEQ-approved 2007 modeling for the initial permit application. The property boundary / public access limit was used as the ambient air boundary for this analysis. Model receptors were placed from the public access limit out at least 5 kilometers in every direction. The dense inner model receptors can be seen as black dots outside the ambient air boundary in Figure 2. The AERMOD modeling domain was conservatively calculated to include nearly the entire USGS quad for any receptor or any elevated point beyond the edge of the receptor network that meets the AERMAP / AERMOD guidance condition of 10% elevation gain. This method is built into the BeeLine BEEST software used to prepare these analyses, and is recommended as conservative in meeting or exceeding new EPA guidance by software developer Dick Perry of Bee-Line software.

Receptor density is 25 meters along the ambient air boundary, 50 meters for at least the first 100 meters, then 100 meters out to 400 meters away from the property boundary, 250 meters out to 1,000 meters from the ambient air boundary, 500 meters for the next 4 kilometers to 5 kilometers. A few receptors onsite at Great Western Malt were eliminated because that facility had slightly elevated impacts there, where they were not enforceable. Model results for the subgroup Hoku shows that predicted impacts in that vicinity from the proposed action were insignificant.

Figure 3 shows the facility and its ambient air boundary (the white spot in the middle of dense inner receptor network that show up as black in the center), the receptor network (the black dots around the denser inner model receptors), the model domain (green line just inside

USGS quad lines around the receptor network), the latitude and longitude grids in the vicinity, and the USGS quad maps that cover the model domain.

Figure 3 Model Domain and Receptor Network



All model predicted maximum facility impacts occurred at or within 10 meters of the ambient air boundary, within the 25 meter grid density. The maximum impacts are shown to drop off considerably moving toward the outer edge of the receptor network.

The receptor networks employed were consistent with those in the IDEQ approved modeling protocol, and ensured that the analysis meets or exceeds IDEQ receptor network requirements and capture the maximum impact from the facility. Therefore, no supplemental receptor network or expansion of the model domain was required or included.

AERMAP INPUT AND ELEVATION DATA

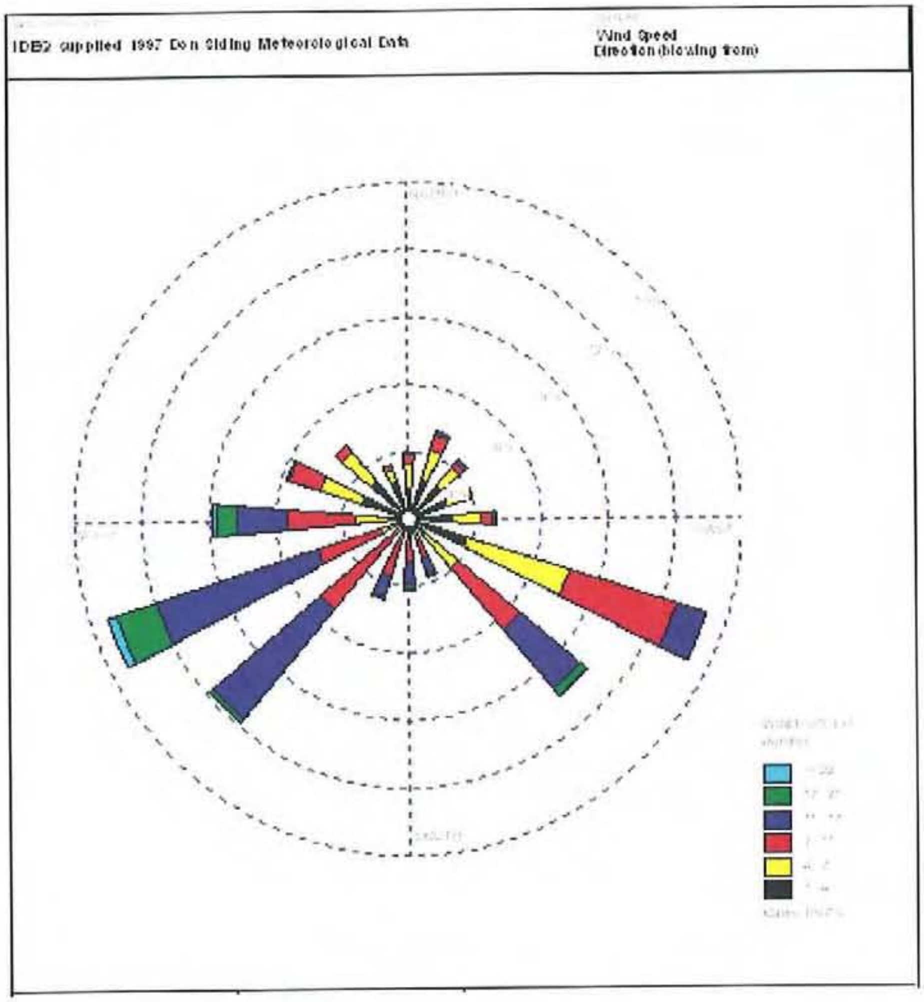
All details in this section are exactly as described in the IDEQ-approved modeling protocol, though AERMAP had to be rerun to accommodate the changes in layout within the facility from previously permitted layout. All building and source base and receptor elevations were calculated from USGS 7.5-degree (30m or less horizontal resolution) DEM data (UTM NAD 27) downloaded from Geo Community (www.geocommunity.com), the USGS freeware download system, using the Bee-Line BEEST preprocessing system. That same DEM data was used in the AERMAP preprocessor to prepare the terrain data for the model domain to run AERMOD. The anchor location and user location required by AERMAP was near the center of the Hoku facility. Electronic data files sufficient to review or duplicate the AERMAP model application are included with this report.

METEOROLOGICAL DATA AND LOCAL PARAMETERS

Model meteorological data recommended for use in this analysis was provided by IDEQ, and applied exactly as described in the IDEQ-approved modeling protocol. The data provided was collected in 1997 at the Simplot Don Siding site #1 location, approximately two miles NW of the Hoku location. The Hoku site is deep enough in the Portneuf Valley to be blocked from the prevailing Snake River Plain WSW winds. The Simplot Don Siding plant is at the mouth of the Portneuf Valley and more exposed to the Snake River Plain winds, though not as exposed to those flows as the Pocatello airport. Though IDEQ approved consideration of wind flow direction alternation to make the Don Siding data more representative, the two convergent flows from the Portneuf Valley and the Snake River Plain made any flow direction alterations challenging to justify. The modeling analyses were performed without any alterations to the Don Siding meteorological data. Default meteorological settings were employed, except that missing hours in the IDEQ-supplied data had to be allowed. Those analyses are understood to be quite conservative, since the modeling meteorological file shows strong winds to the ENE toward the population in the area that are not representative of the actual Hoku location. Hoku reserves the right to consider more representative meteorological data, or an alternative representation of this data, for future modeling analyses. Modeling analyses were prepared for the complete extent of the one year meteorological data file IDEQ provided.

Figure 4 shows the wind rose for the Don Siding meteorological data file used in the modeling. As noted, the strong W and WSW components are questionably representative of the Hoku location within the Portneuf Valley. The use of this meteorological file provides a conservative estimate of impacts to the populated east and northeast of the facility.

Figure 4 Don Siding 1997 Wind Rose



LAND USE CLASSIFICATION

Though the facility is within the Pocatello city limits and there is some industrial land use in the vicinity, by the traditional Auer algorithm or most other reasoning, the land in the vicinity of the facility, across the model domain is generally open and features limited development that will affect wind flow at emission release heights. Therefore, as described in the IDEQ-approved modeling protocol, the urban dispersion algorithm was not employed in this analysis; the rural dispersion algorithms were used.

BACKGROUND CONCENTRATIONS

The background concentrations to be used were recommended by Mr. Schilling of IDEQ. They were applied exactly as described in the IDEQ-approved modeling protocol. The Simplot facility approximately 2-3 miles NW of the Hoku facility is a potentially significant source of criteria pollutants. Mr. Schilling recommended using a high PM-10 background of 94.6 ug/m^3, but not including Simplot as a potential co-contributing source. That approach is employed in this analysis. Background concentrations for other criteria pollutants and averaging periods modeled were recommended by Mr. Schilling from the Pocatello area SIP analysis. Those values are shown below in Table 2.

EVALUATION OF COMPLIANCE WITH IMPACT STANDARDS

The impact limit standard applicable to this permit application are the National Ambient Air Quality Standards (NAAQS) for criteria pollutants, and the IDAPA 58.01.01.585 and 586 limits for TAPs listed in Table 2. Predicted total concentrations reported is the model predicted maximum ambient impacts during facility operation plus background concentrations for criteria pollutants. Model predicted maximum impacts reported are the highest predicted impact for the annual average period and for all TAP analyses, and highest second maximum for all shorter averaging periods for criteria pollutants, consistent with the modeling protocol and IDEQ's comments. Table 2 shows the maximum model predicted impact each year for each pollutant for each averaging period modeled.

Table 2 reports predicted maximum model predicted impacts and associated worst-case ambient concentrations as a result of the proposed action. This table provides all model impact results required on the IDEQ MI forms. Predicted maximum impacts and ambient concentrations do not approach or exceed any applicable impact standard.

Table 2
Background Concentrations, Ambient Impact Limits and Method of Comparison with Ambient Air Quality Standards

Pollutant	Averaging Period	Background Concentration ($\mu g/m^3$)	Modeled Maximum Impact ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	IDEQ AAC or AACC ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	Total Conc. as % of applicable Impact limit
PM_{10}	24-hour	94.6	45.3	139.9	-	150	93.3%
	Annual	25	9.6	34.6	-	50	69.2%
NO_2	Annual	32	8.2	40.2	-	100	40.2%
SO_2	3-hour	34	86.3	120.3	-	1300	9.3%
	24-hour	26	24.9	50.9	-	365	14.0%
	Annual	8	0.5	8.5	-	80	10.6%
CO	1-hour	5000	464	5464	-	40000	13.7%
	8-hour	2000	136	2136	-	10000	21.4%
HCl	24-hour	-	267	-	375		71.2%
Arsenic	Annual	-	0.00001	-	2.3E-04		6.2%
Benzene	Annual	-	0.00024	-	0.12		0.2%
Benzo-a-pyrene	Annual	-	<0.00001	-	3.0E-04		small
Cadmium	Annual	-	0.00008	-	5.6E-04		17.9%
Formaldehyde	Annual	-	0.00452	-	0.077		8.7%
Nickel	Annual	-	0.00015	-	4.2E-03		35.7%
PAHs	Annual	-	<0.00001	-	0.014		small

The maximum model predicted impacts for arsenic and nickel, the two TAPs modeled as normalized "NGTAPs" with an emission rate of 1 ton per year, were calculated as follows from the model results of a maximum annual average impact of 0.15619 g/m^3:

Arsenic: (Actaul emission rate of 9.18E-05 tons/yr)(0.15619 ug/m^3/ton per year of emissions) = 1.43E-05 ug/m^3
Nickel: (Actaul emission rate of 9.64E-04 tons/yr)(0.15619 ug/m^3/ton per year of emissions) = 1.51E-04 ug/m^3

Maximum model predicted impacts for each pollutant and averaging period occurred at or within 10 meters of the ambient air boundary. The maximum impacts are shown to be well below all applicable impact limits for all TAPs. None of the predicted maximum TAP impacts reached half the applicable standard. Total concentrations under worst-case operating conditions would not reach half the NAAQS for any pollutant other than PM-10. The PM-10 impacts and maximum ambient concentrations are shown to be well below applicable impact limits for the annual average period. The primary reason that total PM-10 concentrations are predicted to exceed half the NAAQS is because the IDEQ recommended background concentrations themselves are at least half the NAAQS. Maximum predicted facility impacts are shown to be low enough to prevent any exceedances of that NAAQS under worst case operating conditions, though.

Figure 5 shows the maximum model predicted 24-hour average facility PM-10 impacts. Color coding shows the maximum facility impacts occurring on the western property boundary in the vicinity of the lab building near the southwest property boundary. Impacts are predicted to be considerably lower along the rest of the property boundary, except where Great Western emissions elevate impacts on the east end of the facility. All receptors with predicted second maximum 24-hour average impacts over 10 ug/m^3 are shown in bold. As with all other pollutants, predicted impacts drop off promptly and continuously away from the ambient air boundary. All significant impacts for PM-10 are bounded within the model receptor network.

Figure 5 Model Predicted Maximum 24-hour Average PM-10 Impacts